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This background document presents the technical support and rationale for the development of treatment standards for K061 wastewaters. This document is issued as an addendum to the August 1988 background document for K061, which accompanied the rulemaking for nonwastewater forms of K061.
The Agency is proposing to regulate the same four BDAT list metal constituents that are regulated in K061 nonwastewaters.

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PROPOSED
BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR K061 (ADDENDUM)

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Note: This Background Document is an addendum to the August 1988 Final Best Demonstrated Available Technology (BDAT) Background Document for K061

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1. EXECUTIVE SUMMARY

This background document presents the technical support and rationale for the development of treatment standards for K061 wastewaters. Treatment standards for nonwastewater forms of K061 were promulgated in the First Third final rule (53 FR 31138, August 17, 1988). This background document is issued as an addendum to the August 1988 background document for K061 (USEPA 1988a), which accompanied the rulemaking for nonwastewater forms of K061. Treatment standards for wastewater forms of K061 were not promulgated as part of the First Third rulemaking in order to allow the Agency time for additional data collection and analysis. Information contained in the August 1988 background document is not repeated in this document.

In addition, EPA is proposing to revise the promulgated treatment standard for the high zinc (>15 percent zinc) subcategory of K061 nonwastewaters. In the First Third final rule, the standard for the high zinc subcategory was "No Land Disposal Based on High Temperature Metals Recovery as a Method of Treatment." EPA proposes to revise the standard to be "Resmelting in a High Temperature Zinc Metal Recovery Furnace." Specifying this treatment method more accurately reflects the Agency's intentions in promulgating the First Third rule, and does not reflect a change in regulatory approach. With respect to the treatment standards for the high zinc subcategory of K061 nonwastewaters, the Agency is also soliciting comment regarding the advisability of extending the duration of the existing, interim treatment standards for another year. Further discussion of the rationale for revising the treatment standard for the high zinc subcategory of K061 nonwastewaters and extending the interim treatment standards will not be provided here, but can be found in the preamble to the Third Third proposed rule.

This document presents information specific to the treatment of K061 wastewaters and the technologies that were evaluated in the determination of best demonstrated available technology (BDAT) for K061 wastewaters.

The Agency is proposing to regulate the same four BDAT list metal constituents that are regulated in K061 nonwastewaters--cadmium, chromium, lead, and nickel. These standards are based on the transfer of treatment performance data from treatment of a similar metal-bearing wastewater (K062) using a treatment system consisting of hexavalent chromium reduction and chemical precipitation, followed by dewatering of the precipitate.

Proposed treatment standards for K061 wastewaters are presented in Table 1-1.

Table 1-1. BDAT Treatment Standards for K061 Wastewaters

Constituent	Maximum for any single grab sample: Total concentration (mg/l)	Maximum for any single grab sample: TCLP (mg/l)
Cadmium	1.61	Not applicable
Chromium (total)	0.32	Not applicable
Lead	0.04	Not applicable
Nickel	0.44	Not applicable

2. INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

2.1 Industry Affected

K061 waste is generated by the iron and steel industry and is defined as emission control dust/sludge from the primary production of steel in electric furnaces. The Agency has no new data that would change the description of the iron and steel industry that was contained in the August 1988 K061 background document (USEPA 1988a).

2.2 Waste Characterization

The August 1988 K061 background document contained waste characterization data for nonwastewater forms of K061. As defined by EPA, the wastewater form of K061 waste has less than 1 percent total suspended solids and less than 1 percent total organic carbon. K061 wastewaters can be generated from electric furnace air pollution control scrubber blowdown, dewatered sludges, leachates from landfills, and CERCLA sites, as well as during corrective actions at RCRA facilities. Waste characterization data for wastewater forms of K061 are presented in Table 2-1 of this amendment. Three data points for untreated K061 wastewaters were collected by EPA's Office of Water for the Effluent Limitations Guidelines for the iron and steel industry (USEPA 1982). One data point for K061 wastewater was submitted by industry and claimed as CBI. The Agency has made no attempt to validate the accuracy or representativeness of these waste characterization data.

Table 2-1. K061 Wastewater Characterization Data (mg/l)

Constituent	Plant Identification			
	051[a]	052[a]	059A[a]	CBI[b]
Antimony	0.67	-	-	-
Arsenic	1.23	-	-	CBI
Barium	-	-	-	CBI
Cadmium	3.33	-	-	CBI
Chromium	4.30	-	-	CBI
Copper	1.33	-	-	-
Lead	23.3	-	-	CBI
Mercury	-	-	-	CBI
Nickel	0.043	-	-	-
Selenium	-	-	-	CBI
Silver	0.063	-	-	CBI
Zinc	100	27	190	CBI
pH	7.1-7.2	8.4-9.6	6.6-7.5	CBI
Suspended Solids	2843	883	6308	-

- = No data reported.

[a] USEPA, 1982.

[b] Industry-submitted data (CBI).

3. APPLICABLE AND DEMONSTRATED TECHNOLOGIES

For K061 wastewaters, the Agency believes that the applicable treatment technologies include chemical precipitation, followed by settling, filtration, and dewatering of solids. In addition, hexavalent chromium is likely to be present because of the highly oxidative environment in the electric furnace (air and pure oxygen at high temperature). This indicates the need for chromium reduction to convert hexavalent chromium to trivalent chromium prior to metals precipitation. The Agency has identified these treatment technologies because they are designed to reduce the concentration of metals in wastewaters. Other applicable technologies include physical treatment methods that remove suspended solids from wastewaters. These include clarification, flocculation, vacuum filtration, and other similar technologies. The treatment system consisting of hexavalent chromium reduction, chemical precipitation, settling, filtration, and dewatering of solids is an applicable technology for removal of both dissolved and suspended metals from K061 wastewaters.

All of the applicable treatment technologies are also demonstrated because they are used on a full-scale commercial basis for treatment of metal-bearing wastewaters. Hexavalent chromium reduction and chemical precipitation, followed by settling, filtering, and dewatering of solids are widely practiced metals treatment technologies (USEPA 1986a). Physical separation methods are also demonstrated treatment technologies for removal of solids from wastewaters. Regarding treatment of precipitated solids (K061 nonwastewaters), the Agency has previously promulgated treatment standards (USEPA 1988a).

4. PERFORMANCE DATA BASE

The Agency has three data sets for treatment of K061 wastewaters collected by EPA's Office of Water Effluent Guidelines Division (USEPA 1982). The three data sets were collected from different facilities treating K061 wastewaters by physical treatment methods. The treatment technologies consisted of: clarification, thickening, and vacuum filtration (Plant 051); clarification, flocculation, lime neutralization, and vacuum filtration (Plant 052); and clarification and vacuum filtration (Plant 059A). These three treatment performance data sets for K061 wastewaters are presented in Tables 4-1 through 4-3 at the end of this section.

In addition, the Agency has 11 data sets for treatment of metal-bearing wastewaters by hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate (USEPA 1986a). The metal bearing wastewaters included waste code K062 and these data were previously used in the development of treatment standards for K062 in the First Third final rule (USEPA 1988b). These data are presented in Tables 4-4 through 4-14. The Agency believes that the K062 data can be used to assess the performance of these technologies for K061 wastewaters. EPA compared the K062 wastewaters and K061 wastewaters with regard to characteristics that affect treatment performance. Included in this analysis were concentrations of metals, oil and grease, and organic constituents. Of these characteristics, only metals concentration data were available. In general, K061 wastewaters and K062 wastewaters contain similar metal constituents, but K062 has several BDAT list metals at higher concentrations.

Based on information collected from the Generator's survey (USEPA 1986b), K061 wastewaters generally have low concentrations of dissolved metals (i.e. less than 100 ppm) while K062 wastewaters generally contain concentrations of dissolved metals as high as 5,000 ppm. For example,

the Agency has waste characterication data showing that chromium can be present in the untreated K062 wastewaters at concentrations as high as 2,581 mg/l and in K061 wastewaters as high as 4.3 mg/l; lead may be present in K062 in concentrations as high as 212 mg/l and in K061 wastewaters at 23.3 mg/l; and cadmium is present in K062 wastewaters at concentrations as high as 13 mg/l and in K061 wastewaters as high as 3.33 mg/l. EPA would expect that the K062 wastewaters would be more difficult to treat effectively using the treatment system consisting of hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate. Accordingly, EPA is using these performance data for hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate to establish treatment standards for K061 wastewaters.

Table 4-1. Treatment Performance Data for K061 Wastewater by Clarification, Thickening, and Vacuum Filtration

Constituent	Untreated (mg/l)	Treated (mg/l)
Antimony	0.67	0.005
Arsenic	1.23	0.011
Cadmium	3.33	1.5
Chromium	4.30	0.55
Copper	1.33	0.080
Lead	23.3	1.5
Nickel	0.043	0
Silver	0.063	0
Zinc	100	31
pH	7.1-7.2	7.6
Suspended Solids	2843	86

Reference: USEPA 1982.

Table 4-2. Treatment Performance Data for K061 Wastewater by Clarification, Flocculation, Lime Neutralization, and Vacuum Filtration

Constituent	Untreated (mg/l)	Treated (mg/l)
Antimony	-	-
Arsenic	-	-
Cadmium	-	-
Chromium	-	-
Copper	-	-
Lead	-	-
Nickel	-	-
Silver	-	-
Zinc	27	4.4
pH	8.4-9.6	8.5-9.5
Suspended Solids	883	15

- = Data not reported.
Reference: USEPA 1982.

Table 4-3. Treatment Performance Data for K061 Wastewater by Clarification and Vacuum Filtration

Constituent	Untreated (mg/l)	Treated (mg/l)
Antimony	-	-
Arsenic	-	-
Cadmium	-	-
Chromium	-	-
Copper	-	-
Lead	-	-
Nickel	-	-
Silver	-	-
Zinc	190	38
pH	6.6-7.5	7.1-7.9
Suspended Solids	6308	38

- = Data not reported.
Reference: USEPA 1982.

Table 4-4 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #1

Constituent	Untreated K062 waste (mg/l) Sample no. 801	Untreated K062 waste (mg/l) Sample no. 802	Untreated waste composite[a] (mg/l) Sample no. 805	Treated waste (wastewater) (mg/l) Sample no. 806
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	13	<0.5
Chromium (hexavalent)	I	I	893	0.011
Chromium (total)	1800	7000	2581	0.12
Copper	865	306	138	0.21
Lead	<10	<10	64	<0.01
Nickel	3200	2600	471	0.33
Zinc	<2	<2	116	0.125

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-5 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #2

Constituent	Untreated K062 waste (mg/l) Sample no. 801	Untreated K062 waste (mg/l) Sample no. 802	Untreated waste composite[a] (mg/l) Sample no. 813	Treated waste (wastewater) (mg/l) Sample no. 814
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	10	<0.5
Chromium (hexavalent)	I	I	807	0.12
Chromium (total)	1800	7000	2279	0.19
Copper	865	306	133	0.15
Lead	<10	<10	54	<0.01
Nickel	3200	2600	470	0.33
Zinc	<2	<2	4	0.115

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-6 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #3

Constituent	Untreated K062 waste (mg/l) Sample no. 817	Untreated K062 waste (mg/l) Sample no. 802	Untreated waste composite[a] (mg/l) Sample no. 821	Treated waste (wastewater) (mg/l) Sample no. 822
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	5	<0.5
Chromium (hexavalent)	I	I	775	I
Chromium (total)	1700	7000	1990	0.20
Copper	425	306	133	0.21
Lead	<10	<10	<10	<0.01
Nickel	100310	2600	16330	0.33
Zinc	7	<2	3.9	0.140

Design and Operating Data

	Design value	Operating value
pH	8-10	10

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-7 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #4

Constituent	Untreated K062 waste (mg/l) Sample no. 827	Untreated K062 waste (mg/l) Sample no. 802	Untreated K062 waste (mg/l) Sample no. 817	Untreated waste composite[a] (mg/l) Sample no. 829	Treated waste (wastewater) (mg/l) Sample no. 830
Arsenic	2	<1	3	<1	<1
Cadmium	<5	<5	5	<5	<0.5
Chromium (hexavalent)	1	I	I	0.6	0.042
Chromium (total)	142	7000	1700	556	0.10
Copper	42	306	425	88	0.07
Lead	<10	<10	<10	<10	<0.01
Nickel	650	2600	41000	6610	0.33
Zinc	3	<2	7	84	1.62

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-8 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #5

Constituent	Untreated K062 waste (mg/l) Sample no. 801	Untreated K062 waste (mg/l) Sample no. 802	Untreated K062 waste (mg/l) Sample no. 817	Untreated waste composite[a] (mg/l) Sample no. 837	Treated waste (wastewater) (mg/l) Sample no. 838
Arsenic	3	<1	3	<1	<0.1
Cadmium	<5	<5	5	<5	<0.5
Chromium (hexavalent)	I	I	I	917	0.058
Chromium (total)	1800	7000	1700	2236	0.11
Copper	865	306	425	91	0.14
Lead	<10	<10	<10	18	0.01
Nickel	3200	2600	41000	1414	0.31
Zinc	<2	<2	7	71	0.125

Design and Operating Data

	Design value	Operating value
pH	8-10	8

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-9 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #6

Constituent	Untreated K062 waste (mg/l) Sample no. 801	Untreated K062 waste (mg/l) Sample no. 802	Untreated waste composite[a] (mg/l) Sample no. 845	Treated waste (wastewater) (mg/l) Sample no. 846
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	<5	<0.5
Chromium (hexavalent)	I	I	734	I
Chromium (total)	1800	7000	2548	0.10
Copper	865	306	149	0.12
Lead	<10	<10	<10	<0.01
Nickel	3200	2600	588	0.33
Zinc	<2	<2	4	0.095

Design and Operating Data

	Design value	Operating value
pH	8-10	8

I - Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-10 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #7

Constituent	Untreated K062 waste (mg/l) Sample no. 801	Untreated K062 waste (mg/l) Sample no. 802	Untreated waste composite[a] (mg/l) Sample no. 853	Treated waste (wastewater) (mg/l) Sample no. 854
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	10	<0.5
Chromium (hexavalent)	I	I	769	0.12
Chromium (total)	1800	7000	2314	0.12
Copper	865	306	72	0.16
Lead	<10	<10	108	<0.01
Nickel	3200	2600	426	0.40
Zinc	<2	<2	171	0.115

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-11 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #8

Constituent	Untreated K062 waste (mg/l) Sample no. 859	Untreated K062 waste (mg/l) Sample no. 801	Untreated waste composite[a] (mg/l) Sample no. 861	Treated waste (wastewater) (mg/l) Sample no. 862
Arsenic	<1	3	<1	<0.1
Cadmium	<5	<5	<5	<0.5
Chromium (hexavalent)	0.220	I	0.13	<0.01
Chromium (total)	15	1800	831	0.15
Copper	151	865	217	0.16
Lead	<10	<10	212	<0.01
Nickel	90	3200	669	0.36
Zinc	7	9	151	0.13

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-12 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #9

Constituent	Untreated K062 waste (mg/l) Sample no. 867	Untreated K062 waste (mg/l) Sample no. 801	Untreated K062 waste (mg/l) Sample no. 802	Untreated waste composite[a] (mg/l) Sample no. 869	Treated waste (wastewater (mg/l) Sample no. 870
Arsenic	<0.1	3	<1	<1	<0.1
Cadmium	<0.5	<5	<5	<5	<0.5
Chromium (hexavalent)	0.079	I	I	0.07	0.041
Chromium (total)	6	1800	7000	939	0.10
Copper	5	865	306	225	0.08
Lead	<1	<10	<10	<10	<0.01
Nickel	4	3200	2600	940	0.33
Zinc	0.4	<2	<2	5	0.06

Design and Operating Data

	Design value	Operating value
pH	8-10	10

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-13 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #10

Constituent	Untreated K062 waste (mg/l) Sample no. 801	Untreated waste composite[a] (mg/l) Sample no. 885	Treated waste (wastewater) (mg/l) Sample no. 862
Arsenic	<3	<1	<0.10
Cadmium	<5	<5	<0.5
Chromium (hexavalent)	I	0.08	0.106
Chromium (total)	1800	395	0.12
Copper	865	191	0.14
Lead	<10	<10	<0.01
Nickel	3200	712	0.33
Zinc	<2	5	0.070

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

Table 4-14 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #11

Constituent	Untreated K062 waste (mg/l) Sample no. 801	Untreated K062 waste (mg/l) Sample no. 859	Untreated waste composite[a] (mg/l) Sample no. 893	Treated waste (wastewater) (mg/l) Sample no. 894
Arsenic	3	<1	<1	<0.10
Cadmium	<5	<5	23	<5
Chromium (hexavalent)	I	0.220	0.30	<0.01
Chromium (total)	1800	15	617	0.18
Copper	865	151	137	0.24
Lead	<10	<10	136	<0.01
Nickel	3200	90	382	0.39
Zinc	<2	7	135	0.100

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, and other non-K062 waste streams.

Reference: USEPA 1988b.

5. IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

This section presents the rationale for the determination of best demonstrated available technology (BDAT) for K061 wastewaters. The Agency examined all the available treatment performance data for the demonstrated technologies to determine which is best. For K061 wastewaters, the Agency has treatment performance data for three facilities that treat K061 wastewaters using physical separation methods. In addition, treatment performance data are available for a system treating metal-bearing wastewater containing K062 waste that is similar to K061 wastewaters. Based on an evaluation of the untreated waste characteristics that affect treatment performance of these technologies, the Agency has determined that the K062 wastewaters are more difficult to treat than K061 wastewaters.

Available treatment performance data presented in Tables 4-6 through 4-16 for treatment of K062 wastewaters by chromium reduction, chemical precipitation, and dewatering of the precipitate show that treatment levels are substantial. Total chromium was reduced from 2,581 mg/l to 0.12 mg/l; copper from 138 mg/l to 0.2 mg/l; cadmium from 13 mg/l to <0.5 mg/l; nickel from 471 mg/l to 0.33 mg/l; and lead from 64 mg/l to <0.01 mg/l. The data collected from this treatment train for K062 wastewaters were obtained from a well-designed and well-operated system and therefore may be used to compare the treatment performance of demonstrated technologies. As stated previously, the Agency has three data sets for treatment of K061 wastewaters using a physical separation treatment process. Of these three data sets, two of the sets are not usable by the BDAT program to assess the performance of the technologies because chemical analysis is provided only for zinc. Therefore, these two data sets were deleted and not used in the comparison of the technologies. As a result, the one data set for physical treatment

consisting of clarification, thickening, and vacuum filtration was compared to 11 data sets for the treatment train of hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate.

Based on the evaluation of these treatment performance data, the Agency believes that the K062 treatment system consisting of chromium reduction, chemical precipitation, and dewatering of the precipitate represents treatment by BDAT for two reasons. First, the physical treatment system was not considered to be well-designed because it is designed to remove particulates, not dissolved metals in solution, especially hexavalent chromium. Hexavalent chromium reduction and chemical precipitation steps are included in the K062 treatment train to remove metals from solution. Second, the treatment performance achieved by the K062 treatment train is more substantial because it reduces BDAT list metal constituents from much higher concentrations in the untreated waste to levels below those achieved by the K061 physical separation system. Therefore, the Agency is transferring the treatment performance data from this treatment train for K062 wastewaters to K061 wastewaters. The Agency has no evidence to suggest that any further precipitation process would significantly improve the performance. Therefore, the treatment train consisting of hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate represents BDAT for K061 wastewaters.

6. SELECTION OF REGULATED CONSTITUENTS

The Agency presented its selection of regulated constituents for K061 nonwastewaters in Section 6 of the K061 background document (USEPA 1988a). These regulated constituents are:

Cadmium
Chromium (total)
Lead
Nickel

The Agency has no data that would lead it to believe that other constituents may warrant regulation for K061 wastewaters. An evaluation of the available waste characterization data for K061 wastewaters and nonwastewaters (USEPA 1988a) indicates that cadmium, chromium, lead, and nickel are present in the waste at the highest concentrations with the exception of zinc.* Although available waste characteristic data for K061 wastewaters, presented in Table 2-1, show low concentrations of nickel, the Agency would expect concentrations of nickel to be significant in wastes from specialty and stainless steel production. For this reason, nickel has been included as a regulated constituent for both nonwastewater and wastewater forms of K061. Other BDAT list metal constituents that may be present are not regulated since they are expected to be treated by a well-designed and well-operated treatment system. Analytical methods to determine the concentration of BDAT list metal constituents in K061 wastewaters can be found in (USEPA 1986c).

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* Zinc is no longer a BDAT list metal. It appears in 40 CFR 261 Appendix VIII only as the cyanide compound zinc cyanide, which is listed because of its cyanide, not its zinc content.

7. DEVELOPMENT OF TREATMENT STANDARDS

This section presents the calculation of treatment standards for the regulated constituents described in Section 6. The BDAT treatment standards for K061 wastewaters (1) reflect treatment performance data from a well-designed and well-operated treatment system, (2) account for analytical limitations, and (3) have been adjusted for variability resulting from treatment, sampling, and analytical techniques and procedures.

The 11 data sets for treatment of K062 wastewaters by hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate were determined to represent treatment by a well-designed and well-operated treatment system (USEPA 1988b). One data set (Sample Set #11) for cadmium was deleted because of an artificially high detection limit of 5 ppm, which deviated from the other 10 data points having detection limits of 0.5. The remaining analytical data sets for this treatment system were corrected for analytical recovery by multiplying the data by their respective correction factors. The correction factors were obtained by dividing 100 by the corresponding percent recovery of the regulated constituents. The percent recovery values for the regulated constituents were transferred from the Onsite Engineering Report for Horsehead Resource Development Co., Inc. for K061 (USEPA 1987), since recovery values were not available for the treatment data on K062. An expanded description of the rationale for this transfer of recovery data is presented in the K062 nonwastewater background document (USEPA 1988b). The matrix spike recovery data used are presented in Table 7-1. The corrected values for the K061 wastewater regulated constituents are presented in Table 7-2.

An arithmetic average of accuracy-corrected concentration levels for each regulated constituent and a variability factor for each regulated

constituent were then calculated. The treatment standard for each regulated constituent was calculated by multiplying the average accuracy-corrected data by the appropriate variability factor. The calculation of the treatment standards for K061 wastewaters is presented in Table 7-3.

Table 7-4 presents the treatment standards for K061 wastewaters.

Table 7-1 Matrix Spike Recovery of TCLP Extract of Treated K061 Waste and Accuracy Correction Factors for High Temperature Metals Recovery

BDAT constituent	Sample				Sample duplicate		
	Original sample (μg/l	Spike added (μg/l	Spike result (μg/l)	Percent recovery[a]	Spike result (μg/l)	Percent recovery[a]	Correction factor (μg/l)
Cadmium	4.2	25	26	87	27	91	1.15
Chromium	<4.0	50	35	70	34	68	1.47
Lead	<5.0	25	22	88	19	76	1.32
Nickel	203	1,000	1,140	94	1,128	93	1.08

[a] Percent Recovery = [(Spike Result - Original Amount)/Spike Added] x 100.

Reference: USEPA 1987.

Table 7-2 Calculation of Corrected Values for Regulated Constituents for Treated Wastewater

Constituent	Treated waste (mg/l)	Percent recovery[a]	Correction factor	Corrected value (mg/l)
Cadmium	<0.5	87	1.15	<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
Chromium (total)	0.12	68	1.47	0.1764
	0.12			0.1764
	0.20			0.294
	0.10			0.147
	0.11			0.162
	0.10			0.147
	0.12			0.1764
	0.15			0.2205
	0.10			0.147
	0.12			0.1764
	0.18			0.2646
Lead	<0.01	76	1.316	<0.0132
	<0.01			<0.0132
	<0.01			<0.0132
	<0.01			<0.0132
	0.01			0.0132
	<0.01			<0.0132
	<0.01			<0.0132
	<0.01			<0.0132
	<0.01			<0.0132
	<0.01			<0.0132
	<0.01			<0.0132

Table 7-2 (continued)

Constituent	Treated waste (mg/l)	Percent recovery[a]	Correction factor	Corrected value (mg/l)
Nickel	0.33	93	1.075	0.35
	0.33			0.35
	0.33			0.35
	0.33			0.35
	0.31			0.33
	0.33			0.35
	0.40			0.43
	0.36			0.39
	0.33			0.35
	0.33			0.35
	0.39			0.42

[a] The percent recovery has been taken from Table 7-14 of the Onsite Engineering Report for Horsehead Resource Development Co., Inc. for K061 (USEPA 1987).

Table 7-3 Calculation of the Treatment Standards for the Regulated Constituents - Treated Wastewater

Regulated constituent	Conc.	Mean	VF	Treatment standard total concentration (mg/l)
Cadmium	<0.575	0.575	2.8 [a]	1.61
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
Chromium (total)	0.1765	.1898	1.69	0.32
	0.1765			
	0.2941			
	0.1471			
	0.1618			
	0.1471			
	0.1765			
	0.2206			
	0.1471			
	0.1765			
	0.2647			
Lead	<0.0132	0.0132	2.8[a]	0.04
	<0.0132			
	<0.0132			
	<0.0132			
	0.0132			
	<0.0132			
	<0.0132			
	<0.0132			
	<0.0132			
	<0.0132			
	<0.0132			

Table 7-3 (continued)

Regulated constituent	Conc.	Mean	VF	Treatment standard total concentration (mg/l)
Nickel	0.3548	.3685	1.20	0.44
	0.3548			
	0.3548			
	0.3548			
	0.3333			
	0.3548			
	0.4301			
	0.3871			
	0.3548			
	0.3548			
	0.4194			

[a] For cases in which all values are at or below the detection limit, the variability factor is taken as 2.8.

Table 7-4 BDAT Treatment Standards for K061 Wastewaters

Constituent	Maximum for any single grab sample Total concentration (mg/l)	TCLP (mg/l)
Cadmium	1.61	Not applicable
Chromium (total)	0.32	Not applicable
Lead	0.04	Not applicable
Nickel	0.44	Not applicable

8. REFERENCES

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